

- No electronic or mechanical devices which have calculating or programming function.
- You will get no point if use L'ôpital's Rule to calculate limits.

1. (15%) Find the derivative of

$$y = \frac{5x - 2}{x^2 - 1}$$

2. (15%) Use the Chain Rule to find the derivative of $y = \sin^3 4t$.

3. (15%) Find all relative extrema of $f(x) = x^4 - 4x^3 + 2$.

4. (15%) Analyze and sketch the graph of $f(x) = 2x^{5/3} - 5x^{4/3}$.

5. (10%) Calculate

$$\lim_{x \rightarrow 0} \frac{\sin 2x}{\sin 3x}$$

6. (10%) Find the constant a such that the following function is continuous on the entire real line.

$$f(x) = \begin{cases} \frac{4 \sin x}{x} & x < 0 \\ a - 2x & x \geq 0 \end{cases}$$

7. (10%) Given $x^2 + y^2 = 25$, find $\frac{d^2y}{dx^2}$.

8. (10%) A fixed of function f is a real number c such that $f(c) = c$. Prove that if f is differentiable on $(-\infty, \infty)$ and $f'(x) < 1$ for all real numbers, then f has at most one fixed point. (Hint: Use the Mean Value Theorem.)